NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

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No. 684 A.2

RIVER BASIN PLANNING IN THE UNITED STATES

by

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1. River basin planning, as we know it in the United States today, is a product of over a century and a half of experience in adapting fast-growing human occupancy and economic activity to the great complex of land and water resources of the nation. In the early years of our country, we had to deal with much the same problems now faced by the developing nations--problems of economic growth and nation-building in the context of a rapidly growing population.

2. In the earliest efforts to expand beyond the Eastern Seaboard, the primary emphasis was on development of the rivers for navigation.[1] With increasing settlement of the Mississippi Valley, major problems of flood protection arose. By 1900, settlement of the arid and semiarid lands of the West required development for irrigation. To these needs were soon added demands for hydroelectric power and for improvement of the quantity and quality of water supplies. Then, a philosophy of integrated, multiple-purpose river basin planning was formulated as part of a national conservation movement. It was expressed in remarkable complete form in the 1908 report of the Inland Waterways Commission.[2] Finally, when lagging economic activity provided added incentive in the 1930's, the Federal Government assumed major responsibilities for river basin development and intensive planning was begun, resulting in the preparation of plans, at least in outline form, for most of the major river basins of the nation.[3]

3. In the discussion to follow, we present first the basic concept of integrated river basin planning and an idealized methodology for the conduct of such planning. Following this statement on the substance of planning, we examine United States experience in planning during the past 30 years and present some important implications for the developing areas of the world. We shall distinguish those elements of our experience that embody principles of general applicability from those unique to the United States.

Basic Concept of Integrated River Basin Planning

4. The concept of integrated river basin planning, as generally understood in the United States, has two major elements: (a) the multiple use of individual units of river systems, especially multiple use of reservoir storage; and (b) the treatment of the river basin as a hydrologic and physiographic unit.[4]

(a) Multiple-purpose use involves the planning and operation of projects, especially storage reservoirs, to serve all of the needs which the project can be designed to meet, to the full extent that this can be done advantageously, as compared with the cost of single-purpose or other alternative ways of meeting the various needs.

(b) Treating the river basin as a hydrologic and physiographic unit permits proper consideration of the interrelationship of all streams in a basin, the associated ground water, the effects of forest and ground cover, and all land-water relationships pertinent to development and use of the basin's resources. It does not

preclude taking into account, in the planning, the needs or effects outside the basin which are pertinent to optimal use of the basin's resources.

Methodology for River Basin Planning

5. In general terms, the methodology of river basin planning in the United States consists of four steps:[5]

(a) Setting the broad objectives for development. These may be: increase in national income; economic growth; or increase in productivity and income of certain sectors of the economy, specific classes of individuals, or residents of particular regions. This step is generally the task of top policy-makers--the Executive and the Legislature.

(b) Translating the broad development objectives into criteria for use by river basin planners to formulate specific plans. This step includes a delineation of the planning region--the river basin, group of basins, or other region for which a water resource plan is to be prepared. These tasks of criteria-setting are functions for the central policy and planning group of the Executive, with oversight from the Legislature.

(c) Formulating the optimal river basin plan and schedule of development (or alternate plans and schedules) at the local or field level, in terms of these criteria, by choosing from among the many combinations of alternative water control structures and kinds of water-derived products and services. This central core of the planning task is generally carried out by a river basin planning staff given specific responsibility for the purpose.

(d) Review of the proposed river basin plan and proposed schedule (or alternative plans and schedules), and reconsideration of the appropriateness of the objectives and planning criteria in the light of the new information obtained from the completed plan. This step (which comes full circle to Step (a)) is the joint task of the Legislature and the Executive with his central policy and planning group.

6. Often the third step--the field-level planning task--is considered to be the whole of basin planning. Yet, without over-all objectives and without specific guidance on criteria for planning or an assessment of the over-all consequences of a river basin plan, field-level planning would take place largely in the dark. All four steps are essential parts of a valid planning methodology.

7. However, the third step is the heart of the technical planning process. Here we examine further its major elements, of which there are, broadly, three:

(a) Identifying and measuring the physical, economic, and social problems and requirements of the region (in relation to the established broad development objectives) that water resource development can help to solve or meet. This includes making projections of regional population, economic activity, and demands for water-derived products and services under various assumptions of the extent and nature of water resource development.

(b) Identifying and measuring the various opportunities for control and development of the region's water and related land resources to help meet the needs and solve the problems identified in element (a) above.

(c) Given the schedules of demand for water-based products and services, and the opportunities for meeting the demands through water development (where demands are related to the established objectives), the formulating of an optimal water development plan, including a schedule of development. This can be accomplished through systematic analysis of many alternative plans under a procedure that seeks to select successively better and better plans (where improvement is measured in terms of the preassigned objectives of development) until no further improvement can be made. In some cases, alternative plans are developed to meet different mixes of objectives.

8. In the United States, benefit-cost analysis has been highly developed as the basic tool in this process of formulating optimal plans and selecting from among alternatives. The estimated cost of the development plan under review is compared with the estimated benefits, both usually expressed in market value terms. The object is to devise the plan with the greatest excess of benefits over costs. In

general, a plan is not recommended for development unless the ratio of benefits to costs is greater than unity. Although benefits and costs are usually expressed in terms of increases in national income, they can be (and often are) expressed in other terms as well, such as income gains to special groups or regions. Intangible factors--both benefits and costs--are taken into account in the analysis, and are often given implicit weights in monetary terms.

United States Experience and its Implications for Developing Areas

9. Over the past 30 years, the United States has invested about $30 billion in developing its river basins. These developments have varied from relatively small-scale projects, often for a single purpose, to large-scale, complex, multi-purpose undertakings such as the Tennessee Valley development and the major dam and reservoir systems in the Columbia and Missouri basins. From the experience of planning and carrying out these developments, there emerge some generalizations, insights, and principles that should be helpful to others just now starting the planning and development process. Our discussion of United States experience is presented in terms of three major aspects of the planning process: defining goals and objectives, formulating the river basin plan, and organizing and staffing for planning. Brief mention is also made of the problem of basic data for planning. (Although much of the planning, financing, construction, and operation of water resource developments in the United States, particularly hydroelectric power and water supply, has been accomplished by private initiative and local governments, our discussion is centered on comprehensive, multiple-purpose river basin planning, which has been carried out primarily by the Federal Government in cooperation with the States. We omit any discussion of the impact on United States river basin planning of the issues of private versus public development. Although such issues have had important effects on our experience, they are so closely tied to our institutional pattern that few meaningful lessons can be drawn for application elsewhere. For treatment of this aspect of the subject, the reader is referred to the references contained in the footnotes, especially footnotes 2, 3, 6, 7, 8, 16, 18, and 23.)

Defining Goals and Objectives for River Basin Development

10. The most successful river basin developments in the United States have taken place under circumstances where there was general understanding and acceptance of the goals to be attained. Our first fully-integrated river basin development--the Tennessee Valley system--was begun under particularly favorable circumstances in this respect. The Congressional Act of 1933 establishing the Tennessee Valley Authority gave the agency a broad mandate to promote the economic growth of the region through resource development--in particular, through exploiting the navigation and hydro-power resources of the river systems and the fertilizer resources of the region. This general directive was given detailed substance during the formative years of the TVA, but the clear-cut regional development objective which the TVA had from the start allowed the agency to proceed with integrated planning and development in an effective way.[6]

11. Similarly, the large-scale development of the Columbia River basin first began with stimulation of regional employment and economic growth as the major objectives. Bonneville and Grand Coulee dams, although multiple-purpose in concept, were noteworthy because of the large quantities of low-cost hydro-power which they provided. These dams, started in the 1930's and completed in time to make a major contribution of hydroelectric energy to wartime industrial production, were followed by other hydro projects after World War II. Regional development of the Pacific Northwest, primarily through exploiting the hydro-power resources of the Columbia River, but also through navigation, irrigation, flood protection, and other resource development, remains an important goal of public policy today.[7]

12. In partial contrast, the Missouri River basin development did not proceed with so general an agreement on goals and objectives. Although the broad goal of the 1943 Missouri basin development plan was regional economic stabilization and growth, in fact the upper and lower portions of the basin had quite different economic

and resource problems. The solutions to these imposed conflicting demands upon the river system. As a result, compromises were necessary to meet both navigation and flood control needs of the lower basin and a reasonable development of the irrigation and hydro-power recources of the middle and upper basins. Because these compromises did not fully resolve the basic conflicts in demand, problems in allocating the limited available water resource have persisted into the operation stage. [8]

13. Comprehensive planning studies undertaken since World War II have attempted to deal with the problem of goals and objectives in a more systematic way. In this the studies have been only partly successful. In studies of the New England States and of the Arkansas-White-Red river basins of the Southwest, completed in the early 1950's, regional development as such was not the central objective. Rather, emphasis was placed on the contribution that water resource development could make in meeting needs for water-derived products or services arising from the normal economic growth of the region. However, detailed projections of economic activity were not made for these regions; hence it was not possible to estimate future water resource needs in any detail. The results of these surveys were thus presented in terms of inventories of possible water-development projects, rather than in terms of firm water resource development plans with associated time schedules.

14. In more recent studies of the Delaware, Potomac, Southeastern, and Texas River basins, attempts have been made to project regional population and economic activity over a 50-year period to serve as guides for estimating demands for water-related products and services. Although these projections can serve only as rough indicators for the pattern and magnitude of future water demands, they provide a logical and consistent basis for setting forth a plan of water resource development in which individual projects can be scheduled over time and uses can be shifted to accommodate changing demand patterns. In fact, the water-development plan for the Delaware River basin, completed by the Corps of Engineers in 1960 in concert with other Federal and State and local agencies, presents a schedule of site reservation and project construction to meet the projected domestic and industrial water supply needs of the region to the year 2010. [9]

15. Most recent improvements in planning technique relating to goals, objectives, and economic projections are twofold:

(a) River basin planning standards and criteria have been revised in 1962 to emphasize the need for clearly defining the over-all goals or objectives of river development, and to distinguish among goals where conflicts are likely to arise. Thus, the objective of increase in national income is to be distinguished from objectives such as regional economic growth or increasing the income of specific classes or groups of individuals. [10]

(b) Increased emphasis is being given to improving techniques of projecting regional population and economic activity, based upon a single set of national economic projections which is to be periodically revised.

16. Lessons for developing areas may be drawn from the above. Goals and objectives need to be clearly stated by top policy-makers at the start of the planning process. Ideally, these should be consistent for all subnational river basin planning groups. Over-all national projections of economic activity--which may be goals or targets in some developing countries--should be developed, and regional or local projections derived from these should serve as guides to regional or local planning groups.

Formulating River Basin Plans

17. Because the methodology of formulating river basin plans is the product of gradual evolution over the past half-century, our experience can appropriately be described by citing a number of landmark studies. These are merely illustrative, as the present art and science of planning is the composite result of the labors over the years of thousands of engineers and physical and social scientists.

18. One of the best early examples of orderly and systematic planning for an entire river basin is the development plan of the Miami Conservancy District for the Miami River basin in Ohio. Although oriented toward but a single purpose--

flood control--a rather sophisticated methodology was used to examine a large number of alternative combinations of reservoirs and levees in the search for the least costly means of achieving a given physical objective. [11]

19. The inventory surveys of major United States river basins, executed by the Corps of Engineers in the late 1920's and early 1930's, produced a number of significant framework plans consisting of combinations of storage reservoirs designed for flood control, navigation, hydro-power, irrigation, and domestic and industrial water supply. The comparisons of alternatives and economic analyses were not carried out in great detail. Yet it is noteworthy that these inventory surveys formed the basis of much of the river development work of the 1930's and even later years. [12]

20. Building on the Corps of Engineers inventory survey of the Tennessee River basin (which was one of the most detailed and complete of the group), the Tennessee Valley Authority enlarged and refined the plans for the basin as the agency proceeded with its development. Many new insights into the relationships of river system structures and uses were gained in the planning, construction, and operation of this first fully-integrated, multi-purpose river basin development. [13]

21. The art of plan formulation was advanced on other fronts during the late 1930's and the 1940's. The Water Resources Committee of the National Resources Planning Board stimulated comprehensive, multi-purpose planning through Federal-State-local drainage basin committees in all of the major river systems of the country. Also, in 1941, this Committee prepared a statement of national water policy which contained an excellent prescription on river basin plan formulation. [14]

22. By 1950, the principles of integrated planning of river basin developments had been worked out in considerable detail. Following the work of the National Resources Planning Board, a Federal interagency committee had developed an excellent statement of the principles and procedures of economic analysis for application to river basin planning. [15] Yet practice lagged behind principle. Most river basin plans were mere inventories of unrelated projects. Plans were typically oriented to one or two major purposes--flood control and navigation in the case of Corps of Engineers, irrigation in the case of the Bureau of Reclamation--with other uses considered only as incidental. Detailed comparisons of a large number of alternative combinations and detailed optimization studies were the exception rather than the rule. But the decade of the 1950's was nevertheless a period of major advance. The principles and practices of comprehensive planning were given renewed emphasis in the studies and reports of three Presidential Commissions--the Water Resources Policy Commission, the Missouri River Basin Survey Commission, and the Advisory Committee on Water Resources Policy. [16]

23. This period also saw a significant increase in the interest of academic scholars in river basin planning and development problems, especially in economic evaluation. For some years prior to this, a small but growing group of academic economists, largely in the western states, had been giving attention to these problems. [17] Since 1955, a number of significant works have appeared whose impact on planning is only now beginning to be felt. These studies deal principally with the economics of water resource planning and development. They analyze current agency practices in the light of economic principles and suggest various prescriptions to be followed in plan formulation and choice among projects. Although these books and the related work of academic scholars do not provide consistent sets of rules to follow in plan formulation, they give much more detailed treatment to the problems than was available heretofore. [18]

24. The most recent planning experience in the United States has begun to reflect the influences of these movements for improvement both within and outside the Federal Government. Recently completed studies of the Delaware and Potomac River basins, and of the Texas streams, are much more comprehesive in scope than previously was the case. [19] The Delaware River Basin Plan, recently prepared by the Corps of Engineers in cooperation with other Federal agencies, the four States concerned, and local agencies, is a good example of a major advance toward fully comprehensive river basin planning. The basin, covering an area of about 13,000 square miles, has a relatively high population density and degree of urbanization

and industrialization, with a strong further trend in this direction. Projections of population and economic activity in the basin and adjacent areas, to the year 2010, were made for use in defining needs for water-based products or services. A wide range of possible measures to satisfy the needs was considered, including improved land management, local flood protection works, reservoirs of various sizes, flood plain zoning, water quality and ground water control, and a salt water barrier in the Delaware River estuary. A total of 193 major and 386 small reservoir possibilities was considered in formulating the final plan, consisting of 19 major and 39 minor water control projects. Another feature of the plan was the proposal for early acquisition of reservoir site lands in order to preserve them for future use in this densely populated area. [20]

25. There is increasing concern with fundamental research in the process of river basin planning, both by the planning agencies and by university and other outside research groups. The basin research on river system planning, initiated at Harvard University in 1956, has now moved toward the application stage. [21] A number of other universities are now turning to research in this field. The work done to date indicates that the analytical approaches loosely grouped under the terms "operations research" or "systems analysis" can be adapted to the planning of river basin developments by taking advantage of the high-speed computation capabilities of electronic computers. These approaches allow the testing of many more combinations of purposes, project units, and scales of development than was possible under previous techniques. Presently undergoing an extremely rapid evolution, but already available in a form suitable for use in connection with the problems of developing nations, these systems analysis techniques appear to have many promising applications in planning and programming of water and related land resource development. [22]

26. The implications of United States experience in plan formulation can be summarized as follows:

(a) Of prime importance is the way in which the planning problem is set up. We are only now learning the importance of clearly setting forth the objectives to be achieved, of developing planning standards and criteria that flow from these objectives, and of using a methodology to prepare optimal plans in terms of the standards and criteria. When the problem is set up in this way, the respective roles of top policy-makers, central office planners, and river basin technicians in the field emerge clearly. In setting up the task of field-level planning, it is important to view it in comprehensive terms, to include within the purview of planning all relevant purposes and all reasonable means and measures (structural and non-structural) of accomplishing the purposes. The dynamic nature of water resources investment must be recognized; scheduling of investment becomes an integral part of the choice of project and purpose mix. In examining the many alternative river basin plans, a systems approach should be used that takes into account the technological elements of (1) multi-purpose use of water control structures, (2) hydrologic and physiographic unity of river basins and surface-ground water complexes, and (3) the interrelations between the land resource and surface and ground water flows. Analysis of alternative plans should be not in terms of physical outputs alone, or even primarily, but should be framed in economic terms. It is here that United States experience with benefit-cost and systems analysis can be useful.

(b) Benefit-cost analysis in monetary terms can serve as a base for weighing intangible considerations. Alternative plans that include provisions for achieving non-economic objectives can be compared with plans which are optimal from an economic standpoint. Such comparisons provide a valuable aid to judgment on the extent to which a departure from the economically optimal solution is warranted in the interest of attaining or preserving intangible values.

(c) Planning river basin developments should be considered as only a part of total investment planning for all sectors of the economy. This proposition follows from (a), for if the water investment planning task is set up in terms of meeting broad national objectives, it will need to be adapted to the total investment program. De-emphasis of physical results or outputs will serve to remind decision-makers that engineering structures, no matter how grand or impressive in scale of design, are not ends in themselves, but are means toward serving human needs.

Organizing and Staffing

27. The problem of organizing for effective planning of river basin development covers a wide spectrum. Some river basins may lie in an area under the political and managerial control of a single entity. Here the problem would be reduced to assembling and managing the necessary skills. More often, a river basin spans more than one political jurisdiction and involves more than one agency having technical or managerial responsibilities. Also, the political jurisdictions may include more than one national sovereignty. In the United States, river basin planning experience has embraced the entire range from single-entity control to multi-agency, multi-political and even international jurisdictions.

28. Agency functions. Some of the agencies have already been mentioned in the previous discussion. A more complete catalogue is presented below.

29. Planning for the use of rivers for inland navigation is the responsibility of the Army Corps of Engineers, a Federal agency. Flood control planning is also carried out primarily by agencies of the national government--the Department of Agriculture working on upper watershed protection in cooperation with local soil conservation and watershed districts organized under State laws, and the Army Corps of Engineers which plans major reservoir control and other flood protection measures. Large-scale irrigation planning in the West is assigned to the national government's Bureau of Reclamation in the Department of the Interior. This Department also has power marketing responsibility for hydroelectric energy generated at Federal water projects, and nationwide responsibilities for assembly of basic hydrologic data, geologic surveys and topographic mapping, and survey, research, regulatory, and management functions for minerals, public lands, national parks, fish and wildlife resources, and outdoor recreation. The Department of Agriculture also has major forestry research and management responsibilities. In general, State governments also have numerous agencies concerned with this range of functions.

30. Providing domestic and industrial water supplies is primarily the responsibility of individual communities, local water districts, and the States, but the Public Health Service in the Federal Department of Health, Education, and Welfare has survey, research, and regulatory responsibilities for water supply and control of pollution. Several other Federal agencies have authority to help in developing water supplies and improving water quality.

31. Other agencies of the central government actively concerned with river basin planning include the Federal Power Commission and the Department of Commerce.

32. In addition to the numerous Federal agencies involved, the States, interstate and intrastate agencies, and local interests, both public and private, often have a significant role in the planning process. Some States, notably California, have sizable planning and development agencies of their own. In recent years, participation of the States in river basin planning has increased significantly.

33. The great range of interests involved in a modern river basin study has led us to experiment with various integrating or coordinating devices. The Tennessee Valley Authority was such an experiment, in this case giving almost all national planning and development authority to a single regional agency, but leaving State and local authorities relatively untouched. Informal Federal interagency committees, with State participation, were set up in the Missouri and Columbia River basins, and special planning committees or commissions with Federal agency and State representation have been used in the Arkansas-White-Red basins, New England-New York region, and the Texas and Southeast river basins. In other cases, such as the Delaware and Potomac basins, a single Federal agency, the Corps of Engineers, has taken the leadership in planning, with participation from other Federal and State agencies through committees. A Federal-State commission has recently been established by interstate compact to guide further planning and development in the Delaware basin.

34. None of these arrangements has proven to be fully satisfactory or universally applicable in the United States. There is now before the Congress a proposal by the President to establish Federal interagency planning commissions with State participation, as required, for all major river basins. [23]

35. Although United States experience with organizing for planning is specialized and unique, one generalization emerges. So many different interests--national, regional, and local, public and private, rural and urban, agricultural and industrial--impinge on the planning process, that no single planning agency can have purview of all of them. Thus, in developing countries as in the United States, coordinating arrangements and devices will still be necessary, even when the core task of preparing the river basin plan is assigned to a single agency with broad responsibilities.

36. The international aspect. The United States has entered into formal arrangements affecting river basin planning with both of its adjoining neighbors, Canada and Mexico. The International Joint Commission, United States and Canada, is a permanent body to which the two countries may refer problems of mutual concern for study and recommendation. This agency provides the structure through which the appropriate agencies and interests in each country can deal with problems of planning for development of rivers that cross or form the boundary or that flow into or out of boundary waters. [24] The International Boundary and Water Commission, United States and Mexico, was formed to administer the development of certain specific projects and to prepare plans for additional development on rivers of mutual concern. [25]

37. On the whole, both arrangements have worked well. The organizations have been used effectively for coordinating the collection and analysis of basic data, as well as planning and development activities. They have demonstrated the feasibility of two different arrangements for planning: one through the use of established organizations in each country; and, the other, through the use of a special organization administered by representatives of each country. The experience of these organizations with a wide variety of problems may well prove useful to other nations involved in international river basin planning.

38. Staffing for planning and development. As river basin planning grows in complexity and scope, and as closer coordination of separate governmental jurisdictions and agency functions is required, an approach based too exclusively on narrow technical disciplines is far too restrictive. We have found that modern river basin planning requires the application of the talents and skills of many disciplines. The lesson for developing nations is clear. Staffs for river basin planning should be composed of an interdisciplinary team, including not only a wide variety of types of engineers and physical scientists, including civil engineers, hydrologists, meteorologists, geologists, agronomists, soil scientists, and biologists, but also experts in economics, geography, mathematics, sociology, social psychology, political science, law, statistics, and management and administration, among others. In addition, in less-developed nations, the river basin plan should include projections of needs for professional and skilled manpower to carry out the plans and to use the completed facilities, and definite proposals for meeting these manpower needs.

Basic Data for Planning

39. In this brief summary on basic data, we assert that our early experience with basic data for river basin planning will very likely be duplicated by many developing nations. Those who undertook the first comprehensive surveys in the United States had to contend with great gaps and serious inadequacies of basic physical data. Yet, some highly successful developments were undertaken in spite of these handicaps. Fortunately, the importance of systematic collection and analysis of basic physical and economic data has won increasing recognition in this country, so that our situation in this respect is much improved. In a sense, planners will always feel that the available data are not fully adequate for the task at hand. [26]

40. Several suggestions flow from our experience with basic data for planning:

(a) Once the major gaps and inadequacies in basic physical and economic data have been identified, major efforts should be made to institute programs for the systematic and sustained collection and analysis of such data.

(b) Unless available data are very scanty, it is usually possible to do a good deal of planning on a reconnaissance basis, to prepare framework plans that are useful as general guides to development.

(c) It is prudent, however, to avoid heavy commitments of investment in the face of grossly inadequate data. An expedient solution is to resort to construction of river development works in stages and to incorporate flexibility of use into such works, so that shifts in use can be made at moderate cost as required in the future.

CONCLUSIONS

41. This brief review of United States experience in river basin planning has revealed several significant implications of possible interest to developing countries. In recapitulation, the important points are:

(a) Goals and objectives for river basin development should be clearly stated by the top policy-makers at the outset of planning.

(b) Over-all national projections of economic activity or targets for economic development should be established, and regional or local projections or targets should be derived from these as guides for the planners.

(c) The key to successful planning is the manner in which the planning task is set up: planning standards and criteria must flow from the over-all objectives, and a methodology for optimization in terms of these standards must be developed.

(d) Benefit-cost analysis is a useful basic tool for formulating economically optimum plans, and it can be used to evaluate intangible effects as well as effects measured in monetary terms.

(e) Planning river basin development should be considered in the context of total investment planning for all sectors of the economy.

(f) Even river basin planning agencies with very broad mandates and considerable autonomy will find it necessary to set up some type of coordinating arrangements with other central and local governmental units to take account of the diverse interests involved.

(g) A broad, interdisciplinary-team approach is essential to effective planning for comprehensive river basin development; definite provision should be made, in river basin plans, for providing the varied and specialized skills needed to carry out the plans.

(h) Programs for systematic and sustained collection and analysis of basic data are an integral part of the task of river basin planning; where data are seriously lacking, broad plans with provision for flexibility are preferred over plans in great detail.

42. In considering these points, it is well to note possible differences between the planning environment in the United States and in developing countries:

(a) In the United States, river basin development is still an important factor, but not necessarily a dominant one, in advancing the economic development of specific regions or of the country as a whole; whereas in developing countries, development of river basin resources may be a key factor and may merit a large portion of the national effort for economic progress.

(b) In the United States, development has proceeded to a point where needs for improving water quality for many purposes, for enhancing fish and wildlife environment, and for developing recreation opportunities have come to be of equal and sometimes controlling significance in planning river basin developments; whereas in developing countries, the needs for basic economic development in agriculture or industry may warrant greater emphasis, initially at least, on such water uses as irrigation, hydro-power, navigation, or flood control.

(c) In the United States, it has been possible to place great reliance on market prices for computing development costs and benefits, because: (1) markets are highly developed for a great range of inputs and outputs, (2) outputs of commodities or services flowing from water development plans do not comprise so great a proportion of total output as to affect market prices significantly, and (3) constraints on foreign exchange have not been a significant factor. In developing countries, variations in these conditions should be considered in evaluating river basin developments.

FOOTNOTES

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15. Subcommittee on Benefits and Costs, Federal Inter-agency River Basin Committee Proposed Practices for Economic Analysis of River Basin Projects, U.S. Govt. Print. Off., Wash., D. C. (1950); a revised version was published, under the same title, by the Subcommittee on Evaluation Standards, Inter-agency Committee on Water Resources, U.S. Govt. Print. Off., Wash., D. C. (1958).
16. President's Water Resources Policy Commission, A Water Policy for the American People, U.S. Govt. Print. Off., Wash., D.C. (1950); Missouri Basin Survey Commission, footnote 8; and U.S. Presidential Advisory Committee on Water Resources Policy, Water Resources Policy, U.S. Govt. Print. Off., Wash., D.C. (1955).

17. Foremost among these are: S. V. Ciriacy-Wantrup, E. O. Heady, M. M. Kelso, J. Margolis, and M. Regan.

18. The major works are: Leopold, L. and Maddock, T., Jr., The Flood Control Controversy, The Ronald Press Co., New York (1954); Eckstein, O., Water-Resource Development: The Economics of Project Evaluation, Harvard Univ. Press, Cambridge, Mass. (1958); McKean, R., Efficiency in Government through Systems Analysis, with Emphasis on Water Resources Development, John Wiley & Sons, New York (1958); Krutilla, J. and Eckstein, O., Multiple Purpose River Development: Studies in Applied Economic Analysis, The Johns Hopkins Univ. Press, Baltimore, Md. (1958); Ackerman, E. A. and Lof, G., Technology in American Water Development, The Johns Hopkins Univ. Press, Baltimore, Md. (1959); Hirshleifer, J., De Haven, J. C., and Milliman, J. W., Water Supply; Economics, Technology, and Policy, The Univ. of Chicago Press, Chicago (1960); Maass, A. A., Hufschmidt, M. M., et al., referred to in footnote 5.

19. The Report of the U.S. Study Commission - Texas, House Doc. 494, 87th Cong., U.S. Govt. Print. Off., Wash., D.C. (1962); U.S. Army Corps of Engineers, Water Resource Development, Columbia River Basin, House Doc. 403, 87th Cong., U.S. Govt. Print. Off., Wash., D.C. (1962); U.S. Army Corps of Engineers, Potomac River Basin Report (in preparation).

20. See Footnote 9.

21. Results of the first, basin-research stage are reported in Maass, A. A. and Hufschmidt, M. M., et al., referred to in footnote 5.

22. Congressional recognition of the need for comprehensive river basin planning and for improvements in techniques of analysis has been given by a Senate Select Committee on National Water Resources in a recent appraisal of the Nation's water problems. See Senate Report No. 29, 87th Cong., 1st sess., U.S. Govt. Print. Off., Wash., D. C. (1961). The Committee issued a series of subsidiary reports, published as Committee Prints 1-32, 86th Cong. (1959-1960). These are listed on pages 74-75, and summarized on pages 78-130 of the Report.

23. The literature on United States water resource organization is extensive. Good summaries of the problems and issues are: Water Resources, Law and Contemporary Problems, 22, No. 3, Duke Univ. School of Law, Durham, N. C. (1957); Fox, I. K. and Craine, L. E., Organizational Arrangements for Water Development, Natural Resource Journal, 2, 1-44, The Univ. of New Mexico School of Law, Albuquerque, N. Mex. (1962); Martin, R. C., et al., River Basin Administration and the Delaware, Syracuse Univ. Press, Syracuse, N. Y. (1960). See also Maass, A. A. and Hufschmidt, M. M., et al., referred to in footnote 5, Chap. 15.

24. Bloomfield, L. M. and Fitzgerald, G. F., Boundary Waters Problems of Canada and the United States, The Carswell Co., Ltd., Toronto (1958).

25. See Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, Treaty between the United States and Mexico (Feb. 3, 1944), and Protocol (Nov. 14, 1944), U.S. Govt. Print. Off., Wash., D. C. (1946).

26. The standard source on basic data for water planning in this country is: Langbein, W. and Hoyt, W. G., Water Facts for the Nation's Future, The Ronald Press Co., New York (1959).

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